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A botanical and geological trip on the Warrior and Tombigbee rivers in the coastal plain of Alabama

ROLAND M. HARPER

Since Nuttall's memorable journey of exploration on the Ohio, Mississippi, and Arkansas Rivers in the years 1818 to 1820,* probably very few botanists have traveled any considerable distance by daylight on any of the navigable rivers of our coastal plain. At the present time passenger traffic has almost ceased on many rivers which were once important arteries of commerce, partly on account of railroad competition and partly on account of great variations in the volume of water, due presumably to deforestation of drainage areas; and even where there are still regular lines of steamboats it is not easy to plan a satisfactory trip on one of them. For the boat schedules are in many cases irregular, infrequent, or not widely advertised, and the connections with railroads too often inconvenient or uncertain; and above all, when a river journey extends over 100 miles or so a part of it is usually made at night and a good deal of scenery thus missed.

On account of these conditions, previous to the fall of 1908 I had traveled on a river boat but once (and that was for a distance of only about twenty miles, on the Tennessee River in the Paleozoic region of Alabama); but in October of the year named a rare opportunity was presented for a much more extensive river trip, all by daylight, and at the same time with ample facilities for botanizing. An expedition was being organized by Dr. Eugene A. Smith, state geologist of Alabama, for the purpose of clearing up a few doubtful points in stratigraphy by examining the exceptionally complete geological sections displayed in the river-bluffs between Tuscaloosa and Mobile; and the writer was invited to participate. The other members of the party were seven well-known geologists besides Dr. Smith (most of them connected with state geological surveys in the southeastern states), a young minister (who was also a conchologist), a navigator, and a negro cook.

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* See his "Journal of travels into the Arkansa territory," published in 1821, and reprinted in 1905 as vol. 13 of Thwaites's "Early western travels."

The trip was made in an old house-boat refitted for the occasion, towed by a 20-horse-power gasolene launch. Our best speed (including the acceleration of the current of something like a mile an hour) was about six miles an hour; and the distance covered between sunrise and nightfall each day averaged about twenty-six miles, but varied greatly with the number of bluffs to be examined and the difficulties encountered, from one to forty-nine miles.

Our voyage began on the morning of October 7, 1908, at the fall-line on the Warrior River, in the city of Tuscaloosa, and ended on the evening of the 16th at Jackson, near the head of tide-water on the Tombigbee, 261 miles from Tuscaloosa and 100 from Mobile, by the river. Although there would doubtless have been much of botanical interest below Jackson,* the geologists did not care to go any farther than that, for there are said to be no important bluffs on the tidal part of this river. The river at this time was almost at its lowest stage, because its headwaters are mostly in regions which have their greatest rainfall in winter and spring and least in summer and fall, as seems to be the case in most of the country between the mountains and the coastal plain in the southeastern states.† This state of affairs greatly facilitated our examination of the banks, but at the same time it caused most vexatious delays at the shallowest places, which were usually just below the mouths of swift creeks, which bring down coarse sand and gravel faster than the slower current of the river can remove it, and thus form shoals.

But on the whole probably no better season of the year could have been selected, for we enjoyed ideal weather most of the time, and entire freedom from mosquitoes; and although not many plants along the river were in bloom, there were few if any which were not in the right condition for identification.

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*A description of some of the swamps between Jackson and Mobile can be found in Bartram's Travels, part 3, chapter 6; and parts of the same have been described in some of Dr. Mohr's writings. For the region now under consideration there is hardly any previous botanical literature to be cited. Excellent geological descriptions, with cuts of some of the bluffs, by Dr. Smith and others, have been published in Bulletin 43 of the U. S. Geological Survey, 1887, and in the "Report on the geology of the coastal plain of Alabama," issued by the state survey in 1894.

†The surface of the Warrior River at Tuscaloosa is about 90 feet above sea-level at low water, usually in October, and 150 feet at high water, usually in March. (Farther down stream the elevations are of course proportionately lower.) The smallest flow ever recorded there was 90 cubic feet a second, on October, 15, 1897, and the largest 136,687 cubic feet, on April 18, 1900; an enormous variation. The average is about 8,000, which is nearly two cubic feet a second for every square mile drained.

One of the indirect effects of civilization in Alabama is that locks and dams now have to be provided in the larger rivers to make navigation possible at all seasons.* There are to be nine locks between Tuscaloosa and Jackson when the contemplated river "improvements" are completed, but at the time of our trip the second and third (counting from tide-water) were unfinished, and all our difficulties were in the part of the Tombigbee to be served by them, a distance of not quite fifty miles. This system of locks, while it seems to be an economic necessity, is a detriment to science in more ways than one. In the first place, it seriously interrupts the normal life-history or physiographic development of the rivers, and, what was of more concern to our party, it has permanently covered the lowest few feet of one of the most important bluffs with an opaque screen of muddy water.†

The Warrior River has its sources among the Carboniferous plateaus of northern Alabama, leaves the highlands at Tuscaloosa, and at Demopolis, 130 miles farther down, joins the Tombigbee, which derives most of its water above that point from the Cretaceous region of western Alabama and northeastern Mississippi. The Warrior between Tuscaloosa and Demopolis probably averages a little less than 100 yards in width, and the Tombigbee between Demopolis and Jackson a little more. In most of what follows the two rivers will be treated as one, the fact that the name of the lower portion continues up the western instead of the eastern branch at Demopolis being more or less arbitrary or accidental. After passing through Tuscaloosa County this river forms a county boundary the rest of the way to the Gulf,‡ passing the following counties alternately on the right and left: Greene, Hale, Sumter, Marengo, Choctaw, Clarke, and Washington (besides Baldwin and Mobile below the point where our journey ended).

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* Locks for navigation are practically unknown in the other southeastern states, probably because those states have much less heavy freight, such as coal and cement, to export than Alabama has, and also partly because most of the navigable rivers in the other states could not be dammed up much without flooding large areas.

† The only known station in Alabama for *Hymenocallis coronaria* (see Mohr, Contr. U. S. Nat. Herb. **6**: 447. 1901) has probably been destroyed by this time, by the same process.

‡ It is probably largely for this reason that there are no wagon bridges across it below Tuscaloosa County.

Like most rivers of gentle slope, this one meanders so that distances by water are about twice as great as by air line, and forms bluffs on the convex sides of the bends in the usual manner. The bends are naturally shorter and sharper on the Warrior than on the Tombigbee, on account of the smaller volume of water; and for some reason not altogether obvious, they seem to be most frequent in the region of the Eutaw formation, in the upper parts of Hale and Greene counties.

The banks of the river present a variety of aspects, according to the material of which they are composed, and their position with respect to the meanders and to the sun. Lithologically they are sandstone, limestone, clay, sand, mud, or various intermediate conditions; and there is often considerable variation in a single formation. The oldest material is the stratified Cretaceous and Eocene rocks, which in some places extend as much as 200 feet above the water, in steep bluffs, and elsewhere are entirely under water, or concealed by later formations. Capping the stratified rocks on bluffs which extend above high-water mark can often be seen the stiff reddish loam of the Lafayette formation, which is probably Pliocene. Bluffs not more than 30 feet high are often composed entirely of "second bottom" deposits (Pleistocene), which are usually of loose buff-colored loam, and level on top for considerable distances. Recent alluvium is confined chiefly to low banks subject to frequent inundation. These are of comparatively limited extent, however, and there is very little swamp along any of the rivers in the Cretaceous and Eocene regions of Alabama.

The alluvial banks often slide into the river, carrying down whatever trees grow on them (mostly willows in such places) and drowning them. This phenomenon is especially common in the region of the Tuscaloosa formation (which consists mostly of slippery clay, and lines the river-banks for the first 60 miles below Tuscaloosa), where rows of dead willows are in sight from nearly every point. In this same portion of the river, and apparently nowhere else on our route, are many cut-offs or ox-bow lakes, showing that the channel has been shifting there rather frequently. The bars of sand and gravel which give rise to shoals have been mentioned above.

In Choctaw, Clarke, and Washington counties on the last two days of the trip we got frequent glimpses of the "mountains," which are a characteristic feature of this part of Alabama* and adjacent Mississippi, but are almost unknown to botanists and geographers. These are high rocky ridges, mostly of the buhrstone (Middle Eocene) formation, extending in a general northwest-southeast direction. In a few places where the river impinges directly against them they form bluffs over 200 feet high, which is "doing pretty well" for the coastal plain. A distant view of one of them is subjoined. A few plants which grow on them are mentioned in the geological reports cited, and some others will be discussed in the latter part of this paper.

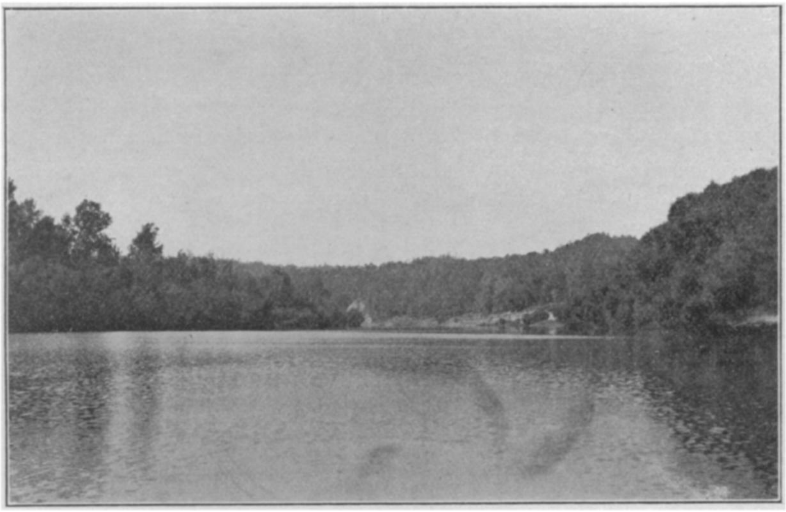

FIGURE 1. Mt. Ararat (near the center) and McCarthy's Bluff, Choctaw County, Alabama, looking downstream from the boat, October 15, 1908.

Four divisions of the Cretaceous strata are represented in western Alabama, namely, the Tuscaloosa, Eutaw, Selma Chalk or Rotten Limestone, and Ripley. These are quite easily recognized along the river by their different appearance or lithological

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*See Smith, Tenth Census U. S. **6**: 55 (line 11), 143–145 [bottom pagination]. 1884; U. S. Geol. Surv. Bull. 43: 35–42. 1887; Geol. of Coastal Plain of Ala. 620–622, 630, 633, 634, 640–641, 645–647. 1894; Mohr, Contr. U. S. Nat. Herb. **6**: 107. 1901.

composition, and in the country away from the river by their characteristic topography and vegetation. The Eocene, which begins at Moscow Bluff on the Tombigbee, about 15 miles below Demopolis and just above the upper mouth of Sucarnochee Creek in Sumter County, has numerous subdivisions, which are not so easily recognized by one who is not a paleontologist, and therefore scarcely need to be mentioned here. Details concerning them can be found in the geological reports cited above.

Except for the locks already mentioned, civilization has not done much damage along the banks of these rivers. The highest bluffs are not cultivated because of their difficulty of access, and the lowest banks because of their liability to inundation, so that such places are generally pretty well wooded. The cultivated fields visible from a boat are mostly in the "second bottoms," just above the reach of floods. And such locations are not considered very healthy to live in, consequently not many houses are to be seen. Cotton warehouses, with inclined tracks leading down to the water, are frequent on the bluffs of the lower Tombigbee, but rare or absent on the Warrior, probably largely because there navigation has hitherto been almost impossible in the fall, which is the cotton season. Lumbering has apparently not been carried on much in the region we traversed, probably because the prevailing trees near the river are hardwoods and short-leaf pines, for which there is not much demand. Long-leaf pine, the most important tree in Alabama, seldom grows on river-banks, but after we came within its range (which was not until the second week) we passed several wood landings and even a few logging railroads, by means of which the trunks of this noble tree were being hauled down from the uplands and embarked on their voyage to the seaport sawmills. Cypress, the most important river-bank tree of the coastal plain, probably never was very abundant along our route, for the banks are in most places too steep for it.

Having sketched the main geographical features of the river, we are now ready to consider in some detail the vegetation along its banks. While the boat was moving I wrote down the names of all the species I could identity, starting anew after every recognizable landing, bluff, creek, etc. As we usually kept near the middle of the river, and no one had thought to bring along a fieldglass, my notes made on the boat were chiefly confined to trees, shrubs, and vines. But our frequent stops at the bluffs, lasting from half an hour to several hours or all night, gave me opportunity to note many herbs and check up my identifications of the woody plants, and to do a little collecting. A few short trips away from the river on foot were also made, the longest being from Beckley's Landing in Marengo County via Myrtlewood to Naheola ferry, a walk of eight or ten miles (with one companion), which cut off about fifteen miles of river. The plants noted on such trips are not counted with those on the river-banks, however.

One extreme method of treating the plants observed would be to combine them all in a single list, and the other would be to consider each geological formation separately and classify the plants growing on or near it according to habitat, as far as possible. But the former method would obscure some interesting features of distribution, and my notes are not complete enough to make it worth while to attempt the latter. Another method would be to consider the Warrior and Tombigbee Rivers separately, thus dividing the journey into two equal parts. But this would be rather arbitrary, for the upper Tombigbee does not flow through any kind of country that the Warrior does not, so that there was no perceptible change of natural conditions as we passed Demopolis except an increased flow of water. (If we had started at the head of navigation on the Tombigbee instead of on the Warrior, then Demopolis might have been a logical dividing point, for the Warrior doubtless brings down from the mountains seeds of quite a number of plants which do not grow along the upper Tombigbee at all.)

The dividing line between the Cretaceous and Eocene formations is a line which several species growing along the river do not seem to cross, and by dividing the notes there some interesting features of distribution can be brought out. That method is here adopted.

In the following table the plants of the Cretaceous and Eocene portions of the river banks are listed in parallel columns. They are divided first into trees, shrubs, and herbs, then arranged in order of apparent frequency, the number prefixed to each being the number of times it was noted in the region under which it is listed. Those seen only once or twice are omitted from this table. The names of vines are italicized, evergreens are in small capitals,* parasites in parentheses, and epiphytes in brackets.† Author-citations are not considered necessary here, and times of flowering, modes of dissemination, etc., are not accurately known in most cases, and are therefore omitted. All the plants visible from the river naturally do not have the same habitat, but it is hardly worth while at this time to go into details of zonation, etc. I have however added the symbol (H) to the names of those species which were seen only on high bluffs or in hammocks or second bottoms, above ordinary high water. Species which grow sometimes above and sometimes below this level are indicated by (h).

CRETACEOUS

TREES

99	Salix nigra
91	Platanus occidentalis
78	Betula nigra
75	Acer saccharinum
68	Planera aquatica
65	Populus deltoides
61	Taxodium distichum
50	PINUS TAEDA (H)
30	Hicoria aquatica
30	Liquidambar Styraciflua (h)
19	Quercus lyrata
9	Fagus grandifolia (H)
8	QUERCUS LAURIFOLIA (H)
6	Morus rubra
5	JUNIPERUS VIRGINIANA (H)
5	PINUS ECHINATA (H)
4	QUERCUS NIGRA (h)
3	Carpinus caroliniana (h)

EOCENE

TREES

82	Salix nigra
77	Populus deltoides
47	Platanus occidentalis
38	Acer saccharinum
24	Planera aquatica
23	Taxodium distichum
22	Betula nigra
14	PINUS TAEDA (H)
11	PINUS GLABRA (H)
9	Liquidambar Styraciflua (h)
7	MAGNOLIA GRANDIFLORA
7	Fraxinus americana ?
5	Fagus grandifolia (H)
3	Morus rubra (h)
3	Hicoria aquatica
3	Cercis canadensis (H)
3	ILEX OPACA (H)

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* [The author preferred to use bold-face type for the evergreens, but for the past eleven years the BULLETIN has reserved that style of type for new names and new combinations of names. — ED.]

† For a more detailed explanation of this method of treating plant lists, see Ann. N. Y. Acad. Sci. 17: 36–39. 1906.

CRETACEOUS

SHRUBS

73	*Brunnichia cirrhosa*
50	(PHORADENDRON FLAVESCENS)
45	ARUNDINARIA MACROSPERMA
16	Alnus rugosa (h)
15	*Tecoma radicans*
7	*Rhus radicans*
5	*Vitis vulpina*
4	Amorpha fruticosa
4	*Ampelopsis arborea*
3	*Bignonia* CRUCIGERA (h)
3	*Ampelopsis cordata*
3	Adelia acuminata

HERBS

36	Onoclea sensibilis
36	*Sicyos angulatus*
20	Aster lateriflorus
18	[TILLANDSIA USNEOIDES]
12	Conoclinium coelestinum
11	Fimbristylis Vahlii
9	Uniola latifolia
7	Osmunda regalis
4	Dianthera americana
4	Panicum virgatum (h)
3	Xanthium sp.
3	[POLYPODIUM POLYPODIOIDES]
3	ADIANTUM CAPILLUS-VENERIS

EOCENE

SHRUBS

44	(PHORADENDRON FLAVESCENS)
25	*Brunnichia cirrhosa*
15	ARUNDINARIA MACROSPERMA
12	Adelia acuminata
12	*Tecoma radicans*
9	*Vitis vulpina*
5	*Ampelopsis arborea*
4	Amorpha fruticosa
4	*Rhus radicans*
3	Cephalanthus occidentalis

HERBS

48	[TILLANDSIA USNEOIDES]
42	*Sicyos angulatus*
14	Dianthera americana
14	Xanthium sp.
9	Onoclea sensibilis
7	*Ipomoea lacunosa*
6	Spermacoce glabra
6	Acuan illinoense
5	Amaranthus sp.
5	Paspalum mucronatum
5	Sesbania macrocarpa
5	Ammannia coccinea
4	Fimbristylis Vahlii
4	Eclipta alba
4	Panicum virgatum (h)
4	Andropogon furcatus (H)
4	Cardiospermum Halicacabum
3	Commelina hirtella
3	Acalypha virginica
3	Euphorbia nutans
3	Echinochloa Crus-galli
3	Leptochloa mucronata
3	Euphorbia humistrata?
3	*Gonolobus laevis ?* *
3	Sida spinosa

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* *Gonolobus laevis* Michx. (*Enslenia albida* Nutt. See Vail, Bull. Torrey Club **26**: 427, 428. 1899.) The plants I examined differ from current descriptions in having no milky juice, and follicles neither angled nor erect; but most descriptions seem to be silent on these points, perhaps not without reason. I preserved no specimens.

The higher numbers for the shrubs and trees in the first column are of course due principally to the fact that we traveled 145 miles through the Cretaceous and only 116 through the Eocene. The slightly greater number of woody plants in the Cretaceous list may be due to the same cause, and the excess of herbs in the second column to the fact that we landed oftener in the Eocene region; but there is also a possibility that this may be a part of the general tendency for woody plants to be most numerous in climax forests and herbs in pioneer forests — the Cretaceous region having of course been above the sea longer than the Eocene.

A few words on habitats should be inserted here. The favorite habitat of the *Alnus*, *Aster*, *Onoclea*, *Osmunda*, and *Adiantum* was at the line of contact between the Cretaceous and second-bottom deposits, where water is perpetually seeping out, on shaded bluffs of moderate height. In such places the four herbs just mentioned usually hang down against vertical cliffs, which in the case of the *Onoclea* and *Osmunda* at least is somewhat of a departure from their habit elsewhere. The *Dianthera*, *Ammannia* and several Cyperaceae not seen often enough to be mentioned in the above table commonly grow on gently sloping clayey Eocene strata near the bases of bluffs, where they are usually moistened by trickling water from above when the river is low and completely submerged when it is high. The *Phoradendron* seemed to grow oftener on *Populus* than on any other tree. It was also frequent on *Acer*, less so on *Betula*, occasional on *Platanus*, but apparently never on *Salix*, *Planera*, or any of the conifers.

If the hammock and high bluff plants, which happen to be mostly trees, be disregarded, the most striking features of both lists are the scarcity of evergreens and the large proportion of vines. This seems to be characteristic of most alluvial forests in temperate eastern North America, especially those of the Mississippi Valley type.* A dense tangle of at least half a dozen species of vines was nearly always in sight, giving the banks in some places, especially where low and swampy, somewhat the appearance of the proverbial tropical jungle. (Many of the species, curiously enough, have near relatives in tropical America.)

The parallel column arrangement brings out the relatively greater prevalence of *Platanus*, *Betula*, *Hicoria aquatica*, *Quercus lyrata*, *Juniperus*, *Alnus*, *Onoclea*, *Aster lateriflorus*, *Conoclinium*, *Uniola*, and *Osmunda* in the Cretaceous region, and of *Populus*, *Pinus glabra*, *Magnolia grandiflora*, *Adelia acuminata*, *Vitis vulpina*, *Tillandsia*, *Dianthera*, *Acuan*, *Spermacoce*, *Paspalum mucronatum*, *Ammannia*, and a few others in the Eocene. All of the former are species of more or less climax tendencies, and all but one or two of them are common above the fall-line, so it is not surprising that they are less frequent coastward. Most of the latter, on the other hand, are confined to the coastal plain, or nearly so. *Alnus rugosa*, common in the Cretaceous, was not noticed in the Eocene region at all, while the reverse is true of *Pinus glabra*, *Magnolia grandiflora*, and *Acuan illinoense*.

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*See Ann. N. Y. Acad. Sci. 17: 69–73. 1906; Torreya 10: 62. Mr 1910.

Considering the table as a whole again, it is noteworthy that most of the species seem to have their greatest development (or centers of distribution) in the Mississippi Valley,* and that most of the monocotyledonous and many of the dicotyledonous genera have tropical representatives. The families most largely represented in the table are Compositae, Euphorbiaceae, Leguminosae, Cupuliferae, Cyperaceae, and Gramineae. Such large families as Solanaceae, Labiatae, Gentianaceae, Ericaceae, Umbelliferae, Hypericaceae, Rosaceae, Cruciferae, Caryophyllaceae, Ranunculaceae, Orchidaceae, Liliaceae, and Juncaceae, and such genera as *Viola*, *Carex*, *Rynchospora*, *Scirpus*, and *Panicum*, which are well represented in other parts of Alabama, are scarce or absent on the river banks. About 20 per cent. of the angiosperms are monocotyledons, but perhaps the number of species involved is too small for this fact to be of much significance.

The weeds † along the river furnish an interesting problem. I was surprised to find them so numerous in spots so remote from human habitations and so rarely trod by the foot of man. They are common on all the bluffs, and as many of them are known to have been introduced from foreign countries in comparatively recent times, the vegetation of some parts of the river-banks must present quite a different appearance now from what it did a century or two ago. Those which were seen more than twice have already been listed above with the native species, without any attempt to separate them. These will be mentioned again below, together with the less frequent weeds.

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* See Ann. N. Y. Acad. Sci. 17 : 74. 1906; Torreya 7 : 44. 1907.

† By "weed" is here meant a species which grows chiefly in unnatural habitats created by civilization. See Bull. Torrey Club 35 : 347. 1908.

For the occurrence of so many weeds (about 40 species were noted on the trip) in such out-of-the-way places the following explanation is suggested: The edaphic conditions on the banks are very diverse, each subdivision of the Cretaceous and Tertiary, as well as the Quaternary second bottoms, furnishing one or more different types of rock or soil, some of which extend only a few feet vertically and a few hundred yards horizontally. In addition to this, the different bluffs face all points of the compass, so that there is a change of environment with every bend in the river. Now if every different formation (and some of them are very different from anything exposed on level ground away from the rivers) had one or more peculiar species adapted to it by processes of evolution, every such river would be bordered by many endemic and very local species. But species (fortunately, one might say) do not seem to be produced quite so freely, and few native plants have been able to grow on the faces of the bluffs at all. The existence of a species confined to a particular kind of river-bluff would be rather precarious, anyway, for the faces of bluffs frequently slough off into the river, destroying all the vegetation on the area affected.

But most weeds are already adapted to diverse soil conditions, and a river is an excellent highway for plants to travel, so that those species which gain access to the river from the fields and settlements along it quickly take possession of the unoccupied bluffs where native plants have been unable to establish themselves. It should not be inferred from this statement however that the bluffs are now completely covered with weeds. A large part of their area is usually too hard or too steep, or crumbling away too rapidly, to afford a foothold for any kind of vegetation, and consequently the bluff weeds are confined chiefly to crevices or to gentle slopes near the base.

Not all of the river-bank weeds are exotics. There seem to be all gradations (if such a thing were possible) between species known to have been introduced from distant parts of the earth and species which are unquestionably native in the vicinity, as proved by the manner of their occurrence in other habitats. There is no known way of distinguishing which are native and which are introduced species by local observation alone, so recourse must be had to the statements in botanical literature, and those unfortunately are sometimes conflicting. According to the latest and best information obtainable, however, the weeds observed on this trip might be classified roughly according to the origin as follows: (There will of course be room for some difference of opinion here, and further study of the behavior of these plants in other parts of this country and in the tropics is needed.)

1. Species endemic to the Eastern United States, and occurring often in perfectly natural habitats, but also capable of flourishing in weedy places.

Spermacoce glabra, *Diodia virginiana*, *Conobea multifida*, *Ipomoea lacunosa*, *Acuan illinoense*, *Fimbristylis Vahlii*, *Panicum virgatum*, *Paspalum mucronatum*, *Andropogon furcatus*.

2. Species supposed to be confined to the Eastern United States, but occurring almost solely in unnatural habitats. Some of these have perhaps never had suspicion cast upon them before, but they will bear watching.*

Spilanthes repens, *Xanthium* sp., *Diospyros virginiana*, *Euphorbia humistrata* (and perhaps one or two of its congeners which I could not identify with certainty), *Acalypha virginica*, *Meibomia* sp. (perhaps more than one), *Glottidium vesicarium*, *Panicum proliferum*.

3. Species apparently native in the Eastern United States, like those in the first group, but occurring also in tropical America.

Conoclinium coelestinum, *Eupatorium serotinum*, *Tecoma radicans*, *Ammannia coccinea*, *Ampelopsis arborea*, *Commelina hirtella*, *Fimbristylis autumnalis*, *Eragrostis hypnoides*.

4. Species common to the Eastern United States and the tropics, supposed by most writers to be native here, but chiefly confined to unnatural habitats, like those in the second group.

Eclipta alba, *Ambrosia trifida*, *Physalis angulata*, *Jussiaea decurrens*, *Euphorbia nutans*, *Sesbania macrocarpa*, *Cebatha Caro-*

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*Bartram's *Oenothera grandiflora*, whose rediscovery farther down this same river in 1904 created a mild sensation among botanists (see Vail, Torreya 5: 9, 10. 1905), probably belongs to the same class.

lina, Mollugo verticillata, Echinochloa Crus-galli, Tripsacum dactyloides.

5. Species believed to have been introduced from the tropics in modern times. (There seem to be no European weeds along these rivers.)

Cardiospermum Halicacabum, Boerhaavia erecta, Leptochloa mucronata, Eleusine indica, Capriola Dactylon, Sorghum halepense.

No information as to relative frequency or local distribution is given in these five lists, but some of the most abundant weeds are mentioned in the first table. Perennials seem to predominate in the first and third classes and annuals in the fourth, but in the whole list of 40 weeds they are about equal in number.

The following notes on particular species are believed to add something worth knowing to our present stock of information about the distribution of each. Specimens of some of them have already been distributed, and such are indicated by numbers.

CAMPANULA AMERICANA L.

Still in bloom on Oct. 16 near the base of St. Stephens Bluff, Washington County, a perpendicular cliff of "White Limestone" about 75 feet high, which faces nearly north. This species is confined chiefly to the Alleghanies and northward, and had never before been reported so far south.

SICYOS ANGULATUS L.

A common vine on densely wooded alluvial banks; seen on every day of the trip, in every county passed, and perhaps over every formation. Still in bloom. Dr. Mohr does not seem to have seen this in Alabama himself, but he reported it from a single locality in Autauga County, where it was collected by Dr. Smith. I have never met with it in any other southern state.

HOUSTONIA ANGUSTIFOLIA Michx.

This is a comparatively rare species, but pretty widely distributed, with a remarkable range of habitat, from limestone rocks to dry sand, both in Georgia and Alabama. On this trip I found it on St. Stephens Bluff, with *Campanula americana.* Dr. Mohr knew it only from dry ridges.

DIAPEDIUM BRACHIATUM (Pursh) Kuntze.

On shaded alluvial banks, Tuscaloosa, Marengo, and Washington counties, nearly past flowering. This genus is an addition to the known flora of the state.

CONOBEA MULTIFIDA (Michx.) Benth.

On exposed loamy banks of the Tombigbee in Sumter County, near Demopolis (*no. 120*) and Moscow. Nearly past flowering. Dr. Mohr knew this only as a ballast plant in Mobile County, but, where I saw it, it seemed as much at home as any of the other river-bank annuals. However, as stated above, there seems to be no criterion for distinguishing native from introduced species in such places.

NYSSA UNIFLORA Wang.

It is perhaps worth recording that this was not seen on the banks of the river at all, but only in a slough on top of a second-bottom bluff in Marengo County nearly opposite the boundary between Sumter and Choctaw. There it was accompanied by *Taxodium distichum*, as is often the case throughout its range.

THASPIUM BARBINODE CHAPMANI C. & R.

On the limestone on the shaded north side of St. Stephens Bluff. Previously known only from Randolph County, Georgia, and Jackson County, Florida, likewise on Eocene limestone.*

AMMANNIA COCCINEA Rottb.

On wet banks, nearer horizontal than vertical, of soft Eocene rock along the Tombigbee in Sumter, Marengo, Choctaw, Clarke, and Washington counties. Known to Dr. Mohr only from Mobile County.

Acer rubrum L. and *Magnolia glauca* L. were not seen at all, probably because they are chiefly confined to areas much farther from base-level (as a physiographer would term it) than the banks of a large sluggish river.

MENISPERMUM CANADENSE L.

On shaded alluvial banks on both sides of the Tombigbee near the northeastern corner of Choctaw County. This is not mentioned in Mohr's Plant Life of Alabama, but it was later reported from the base of Sand Mountain in Jackson County by T. G. Harbison.* It probably does not extend much farther south than where I saw it.

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*See Bull. Torrey Club 33: 240. 1906; Coulter & Rose, Contr. U. S. Nat. Herb. 7: 148. 1900.

ADICEA PUMILA (L.) Raf.

On shaded alluvial bank near Beckley's Landing, Marengo County, and in rich shady woods near Hatchetigbee Bluff, Washington County; accompanied by the somewhat similar *Urticastrum divaricatum* at both places. Apparently not reported from the coastal plain of Alabama before.

FIMBRISTYLIS VAHLII (Lam.) Link.

Rather common on exposed loamy banks, considerably below high-water mark, in Greene, Hale, Sumter, Marengo, and Clarke counties. (*Nos. 117, 118.*) This neat little plant evidently cannot stand, or does not have, much competition, for it grows in scattered tufts, unobstructed by other vegetation. A study of its life-history would doubtless bring out some interesting things. As the places where it grows are often under water, its periods of vegetative activity must be subject to considerable interruption.† To offset this, it seems to have a habit of sending up several successive crops of culms during the season, and of course if any one crop succeeds in maturing seed its purpose is accomplished. Some of the specimens collected show two sets of culms of different ages, perhaps a month or two apart.

Not very much is known about the range and habitat of this species. It is rarely mentioned outside of manuals and monographs, and I had never seen it growing before this time and have not seen it since. Its name does not appear in Mohr's Plant Life of Alabama, but singularly enough there is a specimen of it in the Mohr Herbarium at the University of Alabama, from "Damp alluuvial banks, Chastang's Bluff, Sept. 1, 1879," labeled "*Stenophyllus Stenophyllus*"!

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*Biltmore Bot. Stud. 1: 155. 1902.

† See notes on one of its near relatives, *F. perpusilla*, in Bull. Torrey Club 31: 17–19. 1904. *F. autumnalis* seems to have similar struggles for existence in some places. Very minute specimens of the latter, some not more than an inch tall, but fruiting, were collected on the muddy bottom of a shallow dried-up pond about a mile west of Black Buff, Sumter County, on October 12 (*no. 122*). See also in this connection Fernald in Rhodora 11: 180. S 1909.

HEMICARPHA MICRANTHA (Vahl) Pax.

Seen only on a gentle slope of soft shale (Black Bluff formation), perpetually moistened by water trickling down from the second-bottom deposits a few feet higher up, just below Beckley's Landing, a mile or two north of Myrtlewood, Marengo County, Oct. 13 (*no. 123*). The bulk of the vegetation in this habitat consisted of *Dianthera americana* and various Cyperaceae, one more of which is mentioned below.

This is another species which I have never seen elsewhere in the South. Dr. Mohr reported it from "Low, damp sandy ground, most frequent in flat open grassy pine barrens" (which by the way would be a very unusual habitat for *Hemicarpha*), in Washington, Clarke, and Mobile counties; but the only specimen so labeled in his herbarium at the University (and I am informed that a similar state of affairs exists in his other collection, now deposited in the U. S. National Herbarium), from "Close damp soil, pastures, etc. Mobile. April, May," is *Scirpus carinatus!* *

CYPERUS INFLEXUS Muhl.

Collected at the same time and place as the preceding (*no. 124*), and seen also at Jackson landing, where our river trip terminated. The occurrence of this species in Alabama was not known until I found it on Lookout Mountain in the fall of 1905,† (or in Georgia until I found it on flat granite rocks in Clarke and Clayton counties in the summer of 1900).

HOMALOCENCHRUS LENTICULARIS (Michx.) Scribn.

In wide densely wooded alluvial bottoms, about two miles west of Myrtlewood and the same distance from the Tombigbee River, in Marengo County, Oct. 14. Not previously reported from Alabama.

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* For notes on the occurrence of this species in Alabama, see Bull. Torrey Club 33: 525. 1906.

† See Torreya 6: 115. 1906. It is rather a curious coincidence that I should have been the first to find this species and the preceding in Worcester County, Massachusetts, after two or three floras of the county had been published. (See Rhodora 1: 201, 202. 1899.) There they both grow on the sandy shores of two lakes in Brookfield. For other interesting notes on their occurrence together see Haberer, Rhodora 2: 61. 1900; Blankinship, Rhodora 5: 130. 1903; Fernald, Rhodora 11. 220. 1909; Wiegand, Rhodora 12: 39. 1910.

PASPALUM MUCRONATUM Muhl. (*P. fluitans* Kunth).

Not rare, on shaded alluvial banks, Tuscaloosa (*no. 116*), Sumter, Marengo, Choctaw, and Washington counties. This, too, was new to the known flora of the state.

PINUS PALUSTRIS Mill.

The only places between Tuscaloosa and Jackson where this is visible from the river seem to be the crests of the high Buhrstone ridges or "mountains" above mentioned, in Choctaw and Clarke counties. There a few specimens of this unmistakable pine could barely be distinguished with the naked eye as we floated along. It also grows to some extent on the hills capped with Lafayette red loam around Jackson.

? EQUISETUM ARVENSE L.

Sterile specimens which cannot be distinguished from this species were collected in damp crevices of Ripley (Cretaceous) limestone at Barton's Bluff in Marengo County, about ten miles below Demopolis (*no. 121*). This is just the kind of a place in which one usually finds Equisetums (mostly of the *hyemale* group) in the South, but the finding of *E. arvense* in Alabama was decidedly unexpected. Dr. Gattinger reported it from "moist fields, Cave Spring, E. Tenn.," and Dr. Small in his Flora of the Southeastern U. S. credited it to North Carolina, without definite locality, but these are the only records of its occurrence in the southeastern states that I have found. *E. arvense* in the North is often if not usually a weed, but these specimens appeared decidedly native.

Perhaps if my locality could be visited in spring when the fertile stems are visible this plant would turn out to be something else than *E. arvense;* but it is certainly not one of the three species credited to Alabama by Dr. Mohr, for those are all of the *hyemale* group.

ASPLENIUM ANGUSTIFOLIUM Michx.

Many fine specimens of this, some fruiting (*no. 129*), were found in rich shady woods on the north side of a steep Buhrstone

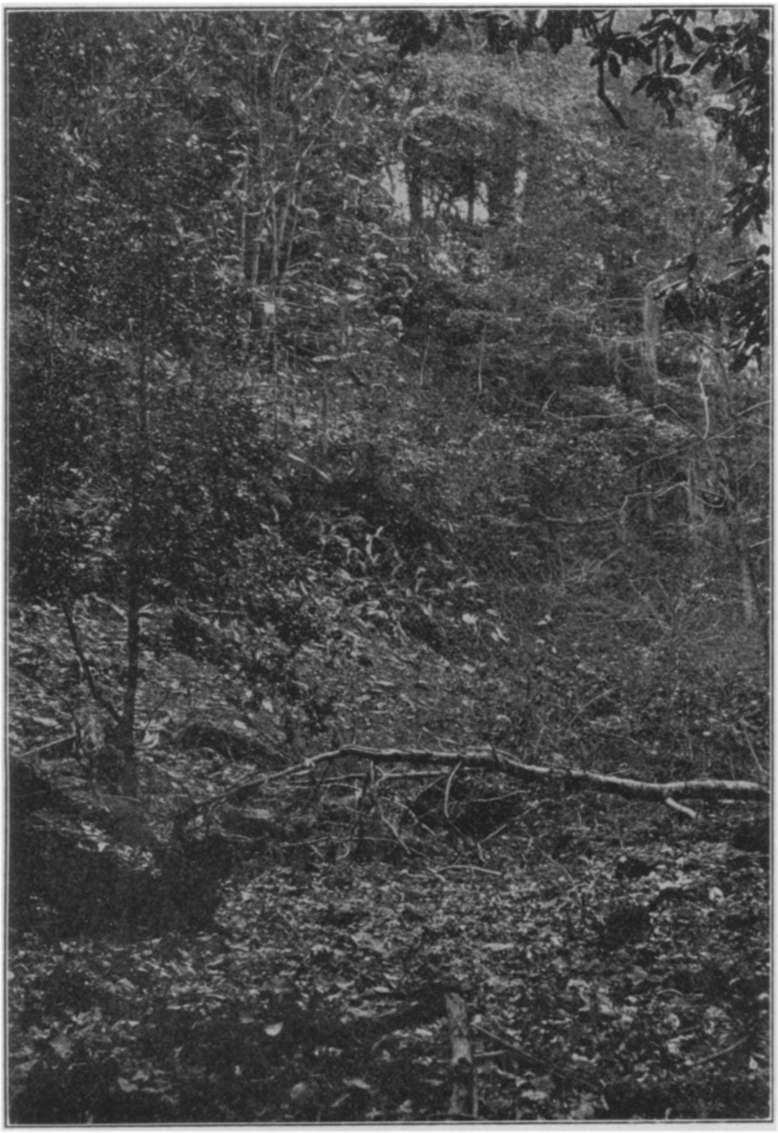

FIGURE 2. Rich shady woods, with *Asplenium angustifolium*, etc., on north side of Hatchetigbee Bluff, Washington County, Alabama, October 16, 1908.

hill rising over 100 feet above the river at Hatchetigbee Landing, Washington County, on the last day of the trip. (See illustration — FIGURE 2.) This was quite a surprise, as the southern limit of this species was previously supposed to be in the mountains of Winston County, about 160 miles farther north and 1,500 feet higher. (The fact that several of the smaller tributaries of the Warrior River flow through Winston County may have something to do with the occurrence of this fern on the Tombigbee.)

At the same time and place I noticed *Scrophularia marilandica*, *Phryma Leptostachya*, *Adicea pumila*, and *Phegopteris hexagonoptera*, which were not known from the coastal plain of Alabama before, and *Panax quinquefolium*, which here reaches just about its southern limit.

TALLAHASSEE, FLORIDA.